

What is claimed is:

1. An air-conditioner unit comprising:

a housing having at least one air inlet for receiving air to be conditioned and at least one outlet for discharging conditioned air into a room,

at least one fan for moving air from said inlet to said outlet,

an air to air heat exchanger to cool said air by diverting and cooling a portion of said air through an evaporative cooling means, heat exchange occurring across a plurality of barriers between said evaporatively cooled air and said incoming air,

a vapour compression-type cooling system having:

an evaporator coil through which the outlet stream of air passes for further cooling said outlet air,

a condenser coil through which said evaporatively cooled air stream that exits said air to air heat exchanger passes, and

a control system that at least determines the temperature of the room air and controls the operation of said air-conditioner to operate only said air to air heat exchanger when said room air temperature is maintained below a pre-determined level and operates both said air to air heat exchanger and said vapour compression type cooling system when the room air temperature is above said pre-determined level.

2. An air conditioner according to claim 1 further comprising a first air inlet receiving outside air and a second air inlets receiving air from the conditioned space, said

air from said first and second inlets being mixed prior to entering said air to air heat exchanger.

3. An air-conditioner according to claim 2 further comprising air flow control means on both said first and second inlets to at least partially open or close to control air flow through said inlets, said air flow control means being operated by said control system.

4. An air-conditioner according to claim 3 wherein said air flow control means on said second air inlet is closed when only said air to air heat exchanger is operating.

5. An air-conditioner according to claim 3 wherein said air flow control means on said first air inlet is partially opened to allow between 20 to 30 percent of total air flow through said first air inlet, and said air flow control means on said second air inlet is partially opened to allow the balance of the total air flow through said second air inlet.

6. An air-conditioner according to claim 1 further comprising a water tank for supplying water to said air to air heat exchanger.

7. An air-conditioner according to claim 6 further comprising a condensate collector on said evaporator coil that drains into said water tank.

8. An air-conditioner according to claim 6 wherein said evaporative cooling means of said air to air heat exchanger comprises a plurality of wicking members located within

a plurality of air flow channels and wherein water from said water tank is supplied to the base of each said wicking member.

9. An air-conditioner according to claim 8 further comprising a secondary water supply that directs water from said water tank to the top of each said wicking member to provide a flushing flow down each said wicking member.

10. An air-conditioner unit comprising:

a housing having at least one air inlet for receiving air to be conditioned and at least one outlet for discharging conditioned air into a room,

at least one fan for moving air from said inlet to said outlet,

an air to air heat exchanger having a plurality of first channels defined by a pair of adjacent walls open at either end through which said air flows,

a plurality of second channels closed at their first end adjacent said first channel openings and open at their second ends adjacent said first channel outlets wherein each of said second channels are formed between the walls of a pair of adjacent ones of said first channels, and evaporative cooling means in each of said second channels wherein a portion of said air flow exiting said first channels is diverted into said second channels to be cooled by said evaporative cooling means thereby cooling said air flow in said first channels by heat exchange across said walls,

an outlet in said housing for discharging exhaust air from said second channels,

a vapour compression-type cooling system having:

an evaporator coil through which the outlet flow of air from said air to air heat exchanger passes for further cooling of said outlet air,

a condenser coil through which said exhaust air from said second channels passes, and

a control system that at least senses the temperature of the room air and controls the operation of said air-conditioner to operate only said air to air heat exchanger when the room air temperature is below a pre-determined amount and operates both said air to air heat exchanger and vapour compression-type cooling system when the room air temperature is above said pre-determined amount.

11. An air-conditioner according to claim 10 further comprising a first air inlet receiving outside air and a second air inlet receiving air from the air conditioned space, said air from said first and second inlets being mixed prior to entering said air to air heat exchanger.

12. An air-conditioner according to claim 11 further comprising air flow control means on both said first and second inlets to at least partially open or close to control air flow through said inlets, said air flow control means being operated by said control system.

13. An air-conditioner according to claim 12 wherein said air flow control means on said second air inlet is closed when only said air to air heat exchanger is operating.

14. An air-conditioner according to claim 12 wherein said air flow control means on said first air inlet is partially opened to allow between 20 to 30 percent of total air flow through said first air inlet, and said air flow control means on said second air inlet is partially opened to allow the balance of the total air flow through said second air inlet.

15. An air-conditioner according to claim 10 further comprising a water tank for supplying water to said air to air heat exchanger.

16. An air-conditioner according to claim 15 further comprising a condensate collector on said evaporator coil that drains into said water tank.

17. An air-conditioner according to claim 15 wherein said evaporative cooling means of said air to air heat exchanger comprises a plurality of wicking sheets against each wall within each of said second channels and wherein water from said water tank is supplied to the base of each said wicking sheet.

18. An air-conditioner according to claim 17 further comprising a secondary water supply that directs water from said water tank to the top of each said wicking sheet to provide a flushing flow down each said sheet.

19. An air-conditioner according to claim 10 further comprising air flow control means on said outlet to restrict air flow therethrough to control the rate of said diverted air flow through said second channels.

20. An air-conditioner according to claim 10 further comprising at least one fan in said outlet for discharging said exhaust air from said second channels.